What is Claimed Is:

1. A process for preparing an aqueous suspension of a crystalline nanoscale ceramic electrolyte material, comprising the steps of:

providing an aqueous suspension of a crystalline nanoscale ceramic electrolyte material;

washing the aqueous suspension;

improving the dispersion of the particles in the washed suspension;

classifying the dispersed suspension; and

concentrating the classified suspension.

2. The process of claim 1, wherein the step of improving the dispersion of the particles in the washed suspension is carried out by sonicating the suspension.

3. The process of claim 1, wherein the step of washing the aqueous suspension is carried out by washing with an aqueous solution containing an organic surfactant.

4. The process of claim 1, wherein the step of providing an aqueous suspension of a crystalline nanoscale ceramic electrolyte material comprises the step of:

providing a crystalline nanoscale ceramic electrolyte material prepared by hydrothermal synthesis.

5. A process for preparing an aqueous suspension of a crystalline nanoscale ceramic electrolyte material, comprising the steps of:

providing a crystalline nanoscale ceramic electrolyte material;

calcining the crystalline nanoscale ceramic electrolyte material;

adding water and a dispersant to the calcined ceramic electrolyte material to form an aqueous suspension; and

attrition milling the aqueous suspension.

6. The process of claim 5, wherein the step of providing a crystalline nanoscale ceramic electrolyte material comprises the step of:

providing a crystalline nanoscale ceramic electrolyte material prepared by hydrothermal synthesis.

7. A process for preparing a ceramic electrolyte coating slurry, comprising the steps of:

preparing an aqueous suspension of a crystalline nanoscale ceramic electrolyte material;

adding at least one water soluble additive selected from a binder and a surfactant to the aqueous suspension; and

adding coarse particles of the ceramic electrolyte to the aqueous suspension.

8. The process of claim 7, wherein the step of preparing an aqueous suspension of a crystalline nanoscale ceramic electrolyte material comprises the steps of:

providing an aqueous suspension of a crystalline nanoscale ceramic electrolyte material,

washing the aqueous suspension;

improving the dispersion of the particles in the washed suspension;

classifying the dispersed suspension; and

concentrating the classified suspension.

9. The process of claim 7, wherein the step of preparing an aqueous suspension of a crystalline nanoscale ceramic electrolyte material comprises the steps of:

providing a crystalline nanoscale ceramic electrolyte material;

calcining the crystalline nanoscale ceramic electrolyte material;

forming an aqueous suspension of the calcined ceramic electrolyte material; and

attrition milling the aqueous suspension.

10. The process of claim 7, wherein the step of preparing an aqueous suspension of the crystalline nanoscale ceramic electrolyte material includes the step of:

providing a crystalline nanoscale ceramic electrolyte material prepared by hydrothermal synthesis.

11. A process for depositing a dense coating of a ceramic electrolyte material onto a porous ceramic substrate, comprising the steps of:

preparing an aqueous suspension of a crystalline nanoscale ceramic electrolyte material;

modifying the aqueous suspension by adding coarse particles of the ceramic electrolyte material and at least one water soluble additive selected from a binder and a surfactant;

spraying the modified suspension onto the surface of a substrate such that a continuous coating approximately 10-80 microns thick is formed on the substrate upon drying of the suspension; and

heating the coated substrate to form a densified ceramic electrolyte material coating approximately 5-40 microns thick.

12. The process of claim 11, wherein the step of preparing an aqueous suspension of a crystalline nanoscale ceramic electrolyte material comprises the steps of:

providing an aqueous suspension of a crystalline nanoscale ceramic electrolyte material;

washing the aqueous suspension;

improving the dispersion of the particles in the washed suspension;

classifying the dispersed suspension; and

concentrating the classified suspension.

13. The process of claim 11, wherein the step of preparing an aqueous suspension of a crystalline nanoscale ceramic electrolyte material comprises the steps of:

providing a crystalline nanoscale ceramic electrolyte material;

calcining the crystalline nanoscale ceramic electrolyte material;

adding water and a dispersant to the calcined ceramic electrolyte material to form an aqueous suspension; and

attrition milling the aqueous suspension.

14. The process of claim 11, wherein the step of preparing an aqueous suspension of a crystalline nanoscale ceramic electrolyte material comprises the step of:

providing a crystalline nanoscale ceramic electrolyte material prepared by hydrothermal synthesis.

15. The process of claim 11, wherein the step of modifying the aqueous suspension by adding at least one water soluble additive is carried out by adding an albumin binder.

16. The process of claim 15, wherein the albumin binder is selected from crude egg albumin, purified egg albumin, and synthetic egg albumin.

17. The process of claim 11, wherein the substrate is a porous ceramic electrode material.

18. The process of claim 17, wherein the porous ceramic electrode material is a cathode.

19. The process of claim 17, wherein the porous ceramic electrode material is an anode.

20. The process of claim 11, further comprising the step of selecting a substrate from a presintered ceramic electrode form, a partially sintered ceramic electrode form, and an unsintered ceramic electrode form.

21. The product formed by the process of:

preparing an aqueous suspension of a crystalline nanoscale ceramic electrolyte material;

modifying the aqueous suspension by adding coarse particles of the ceramic electrolyte material and at least one water soluble additive selected from a binder and a surfactant;

selecting a substrate from a presintered ceramic electrode form, a partially sintered ceramic electrode form, and an unsintered ceramic electrode form;

spraying the modified suspension onto the surface of the substrate such that a continuous coating approximately 10-80 microns thick is formed on the substrate upon drying of the suspension; and

heating the coated substrate to form a densified ceramic electrolyte material coating approximately 5-40 microns thick.

22. A process for preparing an aqueous suspension of yttrium-stabilized zirconia particles, comprising the steps of:

providing an aqueous suspension of crystalline nanoscale yttrium-stabilized zirconia particles;

washing the aqueous suspension;

improving the dispersion of the particles in the washed suspension;

classifying the dispersed suspension; and

concentrating the classified suspension.

23. A process for preparing an aqueous suspension of nanoscale yttrium-stabilized zirconia particles, comprising the steps of:

providing crystalline nanoscale yttrium-stabilized zirconia particles;

calcining the crystalline nanoscale yttrium-stabilized zirconia particles;

forming an aqueous suspension of the calcined yttrium-stabilized zirconia particles; and

attrition milling the aqueous suspension.

24. A process for preparing a ceramic electrolyte coating slurry, comprising the steps of:

preparing an aqueous suspension of crystalline nanoscale yttrium-stabilized zirconia particles;

adding at least one water soluble additive selected from a binder and a surfactant to the aqueous suspension; and

adding coarse particles of the yttrium-stabilized zirconia to the aqueous suspension.

25. The process of claim 24, wherein the step of preparing an aqueous suspension of crystalline nanoscale yttrium-stabilized zirconia particles comprises the steps of:

providing an aqueous suspension of crystalline nanoscale yttrium-stabilized zirconia particles;

washing the aqueous suspension;

improving the dispersion of the particles in the washed suspension;

classifying the dispersed suspension; and

concentrating the classified suspension.

26. The process of claim 24, wherein the step of preparing an aqueous suspension of crystalline nanoscale yttrium-stabilized zirconia particles comprises the steps of:

providing crystalline nanoscale yttrium-stabilized zirconia particles;

calcining the crystalline nanoscale yttrium-stabilized zirconia particles;

forming an aqueous suspension of the calcined particles; and

attrition milling the aqueous suspension.

27. The process of claim 24, wherein the step of preparing an aqueous suspension of crystalline nanoscale yttrium-stabilized zirconia particles comprises the step of:

providing crystalline nanoscale yttrium-stabilized zirconia particles prepared by hydrothermal synthesis.

28. A process for depositing a dense coating of a ceramic electrolyte material onto a porous ceramic substrate, comprising the steps of:

preparing an aqueous suspension of crystalline nanoscale yttrium-stabilized zirconia particles;

modifying the suspension by adding coarse particles of yttrium-stabilized zirconia and at least one water soluble additive selected from a binder and a surfactant;

spraying the modified suspension onto the surface of a substrate such that a continuous coating approximately 10-80 microns thick is formed on the substrate upon drying of the suspension; and

heating the coated substrate to form a densified ceramic electrolyte material coating approximately 5-40 microns thick.

29. The process of claim 28, wherein the step of preparing an aqueous suspension of crystalline nanoscale yttrium-stabilized zirconia particles comprises the steps of:

providing an aqueous suspension of crystalline nanoscale yttrium-stabilized zirconia particles;

washing the aqueous suspension;

improving the dispersion of the particles in the washed suspension;

classifying the dispersed suspension; and

concentrating the classified suspension.

30. The process of claim 28, wherein the step of preparing an aqueous suspension of crystalline nanoscale yttrium-stabilized zirconia particles comprises the steps of:

providing crystalline nanoscale yttrium-stabilized zirconia particles;

calcining the crystalline nanoscale yttrium-stabilized zirconia particles;

forming an aqueous suspension of the calcined particles; and

attrition milling the aqueous suspension.

31. The process of claim 28, wherein the step of preparing an aqueous suspension of crystalline nanoscale yttrium-stabilized zirconia particles comprises the step of:

providing crystalline nanoscale yttrium-stabilized zirconia particles prepared by hydrothermal synthesis.

32. The process of claim 28, wherein the step of modifying the aqueous suspension by adding at least one water soluble additive is carried out by adding an albumin binder.

33. The process of claim 32, wherein the albumin binder is selected from crude egg albumin, purified egg albumin, and synthetic egg albumin.

32. The process of claim 28, wherein the substrate is a porous ceramic electrode material.

33. The process of claim 32, wherein the porous ceramic electrode material is a cathode.

34. The process of claim 32, wherein the porous ceramic electrode material is an anode.

35. The process of claim 28, further comprising the step of selecting a substrate from a presintered porous ceramic electrode form, a partially sintered porous ceramic electrode form, and an unsintered porous ceramic electrode.

36. The process of claim 28, wherein the step of heating the coated substrate to form a densified yttrium-stabilized zirconia coating comprises the steps of:

heating the coated substrate until the binder is removed;

calcining the coated substrate at about 900-1100°C to strengthen the coating; and

sintering the coated substrate between 1300 C and 1400°C to densify the coating.

37. A process for depositing a dense coating of a ceramic electrolyte material onto a porous ceramic substrate, comprising the steps of:

preparing an aqueous suspension of crystalline nanoscale yttrium-stabilized zirconia particles;

modifying the suspension by adding coarse particles of yttrium-stabilized zirconia and an albumin binder to the suspension;

selecting a substrate from a presintered porous ceramic electrode form, a partially sintered porous ceramic electrode form, and an unsintered porous ceramic electrode;

spraying the modified suspension onto the surface of a substrate such that a continuous coating approximately 10-80 microns thick is formed on the substrate upon drying of the suspension;

heating the coated substrate until the binder is removed;

calcining the coated substrate at about 900-1100°C to strengthen the coating; and

sintering the coated substrate between 1300 C and 1400°C to form a densified coating approximately 5-40 microns thick.

38. The product formed by the process of:

preparing an aqueous suspension of crystalline nanoscale yttrium-stabilized zirconia particles;

modifying the aqueous suspension by adding coarse particles of yttrium-stabilized zirconia and at least one water soluble additive selected from a binder and a surfactant;

selecting a substrate from a presintered porous ceramic electrode form, a partially sintered porous ceramic electrode form, and an unsintered porous ceramic electrode form;

spraying the modified suspension onto the surface of the substrate such that a continuous coating approximately 10-80 microns thick is formed on the substrate upon drying of the suspension; and

heating the coated substrate to form a densified ceramic electrolyte material coating approximately 5-40 microns thick.

39. The product formed by the process of:

preparing an aqueous suspension of crystalline nanoscale yttrium-stabilized zirconia particles;

modifying the suspension by adding coarse particles of yttrium-stabilized zirconia and an albumin binder;

selecting a substrate from a presintered porous ceramic electrode form, a partially sintered porous ceramic electrode form, and an unsintered porous ceramic electrode;

spraying the modified suspension onto the surface of a substrate such that a continuous coating approximately 10-80 microns thick is formed on the substrate upon drying of the suspension;

heating the coated substrate until the binder is removed;

calcining the coated substrate at about 900-1100°C to strengthen the coating; and

sintering the coated substrate between 1300 C and 1400°C to form a densified coating approximately 5-40 microns thick.

40. A solid oxide fuel cell formed by the process of:

preparing an aqueous suspension of crystalline nanoscale yttrium-stabilized zirconia particles;

modifying the aqueous suspension by adding coarse particles of yttrium-stabilized zirconia and at least one water soluble additive selected from a binder and a surfactant;

selecting a substrate comprising a first porous ceramic electrode material;

spraying the modified suspension onto the surface of the substrate such that a continuous coating approximately 10-80 microns thick is formed on the substrate upon drying of the suspension;

heating the coated substrate to form a densified ceramic electrolyte film approximately 5-40 microns thick; and

depositing a layer of a second porous ceramic electrode material onto the densified ceramic electrolyte film.

41. The product of claim 40, wherein the first porous ceramic electrode material is a cathode and the second porous ceramic electrode material is an anode.

42. The product of claim 40, wherein the first porous ceramic electrode material is an anode and the second porous ceramic electrode material is a cathode.

43. The product of claim 40, further comprising the step of:

depositing an interlayer between the substrate and the ceramic electrolyte film.

44. The product of claim 40, further comprising the step of:

depositing an interlayer between the ceramic electrolyte film and the second porous ceramic electrode material.

45. The product of claim 40, further comprising the steps of:

depositing a first interlayer between the substrate and the ceramic electrolyte film; and

depositing a second interlayer between the ceramic electrolyte film and the second porous ceramic electrode material.